

11. LAND VEGETATION OF DIEGO GARCIA

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The land vegetation of Diego Garcia consists almost entirely of coconut-dominated woodland, with some small areas of shrubs and occasional relict broadleaf trees. All parts of the atoll have been subject to continuous human interference for almost two hundred years, and man now actively controls vegetation growth in coconut plantations in many areas. Only the beach-crest vegetation, particularly on seaward beaches, is relatively unaltered in form and composition. In spite of this high degree of interference, however, many of the introduced species in the Diego Garcia flora are found at or close to present or former settlement sites, and large parts of the atoll have a much more restricted flora including many species which are presumably indigenous.

Description of the vegetation is made more difficult by the great length, variable width, and physiographic diversity of the land rim. The existence of environmental gradients, especially from seaward to lagoonward shores, and the scale of human interference have combined to form patterns in the vegetation, including zonations and mosaics. We first consider the distribution of vegetation in each of six main sectors of the atoll rim, plus the three lagoon-mouth islands, and then summarise the main types of vegetation present. A final section deals with the vegetation of the human settlements at East Point, Minni Minni, Pointe Marianne and elsewhere. This account is based on field notes made while collecting plants which were subsequently named by the Royal Botanic Gardens, Kew, and by Dr F. R. Fosberg; these determinations, which are used in this paper, are listed in the following chapter. Additional information on vegetation distribution has been obtained from the air photograph cover flown in 1967.

A. Regional description

1. Northeast Point

Physiographically the Northeast Point area consists of a seaward beach, channel beach, and lagoon beach, with a low dune field on the lagoonward half of the land rim and a low-lying flat area between the dune field and the seaward beach ridge. The beach crest vegetation round the entire point is dominated by a zone of Scaevola taccada, in

in places replaced by Tournefortia argentea. On the seaward beach there are occasional specimens of Suriana maritima, and, on the landward side of the beach hedge, Guettarda speciosa. The dune area has been recently cleared and planted with coconut seedlings in circular depressions 2-3 m in diameter and up to 1 m deep. The dominant shrub is low and spindly Scaevola taccada, with, on the largely bare and scoured sand surface, Fimbristylis cymosa and Eragrostis tenella.

The low-lying seaward half of the land rim has a rather uneven surface covered with coconut woodland. The higher better-drained areas have a ground cover of Kalanchoe pinnata, Boerhavia repens, Cyperus dubius, Digitaria horizontalis and Eleusine indica. At slightly lower levels the Kalanchoe is replaced by the sedge Fimbristylis cymosa, and shallow pools in depressions are surrounded with the fern Thelypteris interrupta. The sedge Eleocharis geniculata grows in these pools in water a few inches deep. The common ferns Asplenium nidus and A. longissimum are found at higher levels in the Kalanchoe community, generally growing on the boles or fallen trunks of coconuts.

Further south, especially on the lagoon side, the coconut cover becomes less dense, and there are clumps of tall trees (Tournefortia argentea, Hernandia sonora) with Asplenium and Psilotum beneath.

2. Cust Point isthmus

At its narrowest the Cust Point isthmus is less than 45 m wide, and the seaward and lagoonward beach-crest communities are continuous across the land rim. Both are formed almost exclusively of Scaevola taccada, with occasional Tournefortia argentea and Suriana maritima on the seaward side. There are a few adventitious coconuts and Guettarda speciosa in the middle of the rim at its narrowest. Northward the land rim widens, the two beach-crest communities diverge, and the middle of the rim is covered with coconut woodland with many Hernandia trees and a ground cover of sedges, Kalanchoe and Passiflora. The ground is very damp, and fallen trees are thickly covered with ferns and creepers; one fallen tree was coated with the drab olive alga Lyngbya ceylanica (Myxophyceae). The lagoon beach crest, with its Scaevola hedge, is here topped by narrow dunes, with a pioneer vegetation of young Scaevola, Tournefortia and Calophyllum, and with mature Scaevola and Hernandia farther inland.

3. Minni Minni to East Point

The land rim in this sector consists of a zone of seaward dunes, a zone of dry sand, a zone of low-lying ground with standing water after rains, and a lagoon beach ridge. The seaward dunes are covered with a hedge of Scaevola taccada, with infrequent Suriana on its seaward, and Tournefortia and Guettarda on its landward, sides. The Scaevola belt is 30-50 m wide, with trees up to 6 m tall, and is much overgrown with Cassytha filiformis. The main part of the land rim

is planted with coconuts with very variable undergrowth. On the higher dry areas on the seaward side this generally consists of low trees (Morinda citrifolia, Scaevola taccada, Pipturus argenteus) less than 6 m tall; where this tree layer has been cleared Kalanchoe is dominant. The lower wetter areas in the middle of the land rim are covered with sedges, the fern Asplenium longissimum, and tall Alocasia, mainly A. macrorrhiza but also A. plumbea. The dry sand area on the lagoon side is planted with coconuts in regular rows, with Morinda, Kalanchoe, and many introduced weeds. The lagoon shore has a fringe of Scaevola only 10 m wide (Suriana is absent and Tournefortia almost so), with, in places, very tall Calophyllum and more frequent Hernandia sonora. Near East Point settlement there are many juvenile Casuarina in the open coconut woodland.

4. East Point to Barachois Maurice

South of East Point the land rim vegetation is similar to that to the north, except (a) the seaward Scaevola hedge is lower and narrower, and (b) the lagoonward clumps of Calophyllum and Hernandia in the Scaevola hedge are replaced by Cordia subcordata, Hibiscus tiliaceus and Scaevola. The coconut woodland is lower, with less Morinda, and has an undergrowth of Kalanchoe and Rivina humilis. The small Barachois Carcasse has many young Casuarina round its edges, together with Cordia, and its margins and the surrounding marshy areas are covered with the sedge Cyperus ligularis.

5. Southeast rim

The Southeast rim is topographically more complex than other sectors of the Diego Garcia land rim, with the major lagoon indentations of Barachois Maurice and Barachois Sylvain and a more exposed seaward beach. The seaward beach-crest vegetation is again dominated by Scaevola taccada, but this is much lower than elsewhere (often less than 2 m) and it is often markedly wind-sheared. There are considerable stretches where Scaevola is replaced by Tournefortia argentea (e.g. immediately south of Horsburgh Point), which is unusual elsewhere round the atoll rim; and also patches of Suriana maritima, which is considerably affected by salt-spray and wind and in places is dead. The width of the Scaevola belt is very variable, and may reach 80 m. Inland from the seaward Scaevola hedge the vegetation consists of a mosaic of coconut woodland (mainly towards the lagoon) and pure stands of Scaevola and Suriana. The coconut woodland, except where actively cleared, has an intermediate tree storey with Guetarda and Morinda, and a ground cover of Kalanchoe, Ipomoea, sedges and grasses. The Scaevola and Suriana stands have a fairly uniform height of 3-4 m, and are patchily overgrown with Cassytha; the sand surface under these stands is largely bare, with trailing Cassytha, scattered clumps of Fimbristylis, and patches of a moss (Bryum sp.). The lagoon shore has a discontinuous fringe of Scaevola and some Suriana and Tournefortia, with a ground cover of Ipomoea and Paspalum distichum. The barachois

themselves are unvegetated, except for patches of a sterile grass, probably Paspalum distichum, which are almost submerged at high water. Portulaca colonises the higher gravelly margins of the barachois on the landward side. Landward of the narrow Scaevola zone is coconut woodland with Guettarda: the littoral trees common elsewhere (Calophyllum, Cordia, Hibiscus) are not found along this shore.

6. West rim: southern sector

The southernmost sector of the west rim is flat-lying, with a narrow and low seaward beach ridge. The seaward hedge of Scaevola taccada is here invaded by "inland" species, with frequent Guettarda speciosa close to the shore, and even coconuts in places seaward of Scaevola where the beach is retreating. Tournefortia is found at the southernmost point, and northwards, in places replacing Scaevola.

The land area is dominated by coconuts, in places planted and with ground vegetation cleared, elsewhere forming dense thickets ("Cocos Bon-Dieu"). There is usually a shrub or small tree understorey up to 8 m tall, with Guettarda speciosa, Pipturus argenteus and Morinda citrifolia, and a ground layer of Rivina humilis, Kalanchoe pinnata, Achyranthes canescens, grasses, sedges, and Passiflora suberosa. One or two thickets of Scaevola taccada and Suriana maritima toward the lagoon shore are in the process of being cleared. The denser coconut thicket is quite difficult to penetrate: the fern Asplenium longissimum (Plate 41) is common in the damp undergrowth, together with fungi, particularly the large brown bracket fungus Trametes cingulata on tree trunks. The large and less common fern Asplenium macrophyllum is also found in deep shade in Tournefortia thickets. There are some tall broadleaf trees in addition to the coconuts, generally as scattered individuals and only rarely grouped together. They include large Ficus benghalensis near the occasional settlements, Hernandia sonora, and Ochrosia oppositifolia. Hernandia becomes more common further north, with trees reaching 30 m in height. Cordia subcordata and Calophyllum inophyllum are also seen inland, but are absent from the lagoon shore in this southern sector. The lagoon beach crest has an open hedge of Scaevola, Suriana and Tournefortia, generally only a single plant in width and very different to the tall, dense exclusive Scaevola hedge of the eastern lagoon shore. Small dry barachois have scattered low trees of Casuarina, Cordia and Hernandia.

7. West rim: central sector

Between Mamzelle Adélie and Pointe Marianne the land rim varies in width and topography. Immediately south of Pointe Marianne it consists of a seaward dune ridge, a flat zone of sand and cobbles, a low zone with standing water, and a narrow lagoon beach ridge. The dunes are covered with a community of pure Scaevola taccada, 150-200 m wide. The zone of high sand and cobbles supports coconut woodland

with the undergrowth partially cleared. The low-tree storey in this woodland consists of Guettarda speciosa, Morinda citrifolia and Pipturus argenteus, and the ground cover of Achyranthes canescens, Rivina humilis, some Kalanchoe pinnata, and species of Asplenium. The lagoon beach has a thin growth of Suriana maritima and Scaevola.

As the land rim narrows southwards, Scaevola still tops the seaward ridge, but the coconuts are less numerous and the coconut woodland is in places replaced by an open woodland of Guettarda speciosa, with some tall trees (not shrubs) of Tournefortia argentea and a ground cover of Ipomoea macrantha, Passiflora suberosa and grasses. The lagoon shore along this sector is irregular in plan and lacks a well-developed beach ridge. Most of the headlands are marked by groves of tall Ficus, with a littoral vegetation of Cordia subcordata, Hernandia sonora and straggling Scaevola in the intervening bays.

8. West rim: northern sector

North of Pointe Marianne the land rim is fairly uniform in both topography and vegetation for about 8 km. The high seaward beach ridge is covered with a tall hedge of Scaevola taccada for this whole distance, with very occasional coconuts at the beach crest where retreat is taking place, and some Guettarda close to the shore. The lagoon beach has only a narrow zone of Scaevola, a single shrub wide, except close to Pointe Marianne, where the beach is higher, forms a bar enclosing standing water, and is covered with Scaevola, Tournefortia and Hernandia. The land vegetation in this sector consists of coconut plantation interspersed with medium-sized trees of Hernandia sonora and unusually abundant immature Casuarina. The low tree storey is largely absent, though there is some Morinda citrifolia; the ground cover consists of Kalanchoe pinnata, Achyranthes canescens, and grasses.

At the northwest point itself the land rim broadens to form a wide triangle of land which was only briefly investigated. A traverse was made due east from Simpson Point. The seaward beach-crest Scaevola zone is here succeeded inland by a zone of high coconut-dominated forest with a dense undergrowth of the ferns Asplenium nidus and A. longissimum. A large section of the centre of the rim is formed of low dunes, with an open vegetation of Scaevola, Casuarina, and some coconuts and Hernandia. Wedelia biflora is locally dominant, with a ground cover of Stachytarpheta jamaicensis and Euphorbia cyathophora. Traverses further south also showed a woodland of tall Hernandia and coconuts, with an undergrowth of Scaevola and Wedelia. Other ground plants in this area include Kalanchoe pinnata, Lippia nodiflora, Triumfetta procumbens, Aerva lanata and Psilotum nudum. Many of the trees, particularly tall Hernandia, are densely blanketed at heights up to 25 m by exceptionally luxuriant growths of Cassytha filiformis, and epiphytic vines of introduced Vanilla planifolia were seen on several coconut and Hernandia trees. The lagoon shore is dominated by a woodland of tall Casuarina, with many juveniles, and an undergrowth of Scaevola.

9. West, Middle and East Islands

All three islands at the mouth of the lagoon are covered with a dense woodland in which coconuts are present but not dominant. West Island, the smallest, has a beach crest hedge of Tournefortia and Scaevola, and a poorly developed woodland with some coconuts, Hernandia, immature Cordia, and a single Guettarda. The ground cover in the woodland consists of patches of the grass Stenotaphrum micranthum, forming a carpet 15-20 cm thick, together with Cyperus ligularis, Achyranthes canescens, Passiflora suberosa, Boerhavia repens and Sida parvifolia. There is one species of fern, Asplenium nidus, on coconut boles.

Middle Island is larger, with a shingle rampart enclosing a small lagoon on the south side. The shingle rampart is colonised mainly by Scaevola, together with Tournefortia, Guettarda and Suriana. On the seaward side of the island the beach-crest hedge is dominated by Tournefortia argentea, with subsidiary Scaevola. Tall broadleaf trees in the central woodland include Hernandia sonora, Cordia subcordata and Guettarda speciosa; wild Carica papaya is also present.

East Island is considerably larger than the other two. Its eastern half is covered with a belt of Scaevola taccada up to 5 m tall, with occasional Tournefortia, Guettarda and coconuts, and with small patches of sedges and grasses forming an outpost vegetation on the higher portions of the rock promenade. The western half of the island is covered either with coconut thicket, with an understory of Pipturus argenteus and Carica papaya 6-8 m tall, or with a tall dense woodland of massive Hernandia sonora. This Hernandia woodland has an understorey of Guettarda, and a ground cover of Rivina humilis, Asplenium nidus, Achyranthes canescens, Boerhavia repens, Passiflora suberosa, Stachytarpheta jamaicensis, Cyperus ligularis and Stenotaphrum micranthum.

Bourne (in Hemsley 1887, 334) noted the absence of coconut palms on all these islands.

10. Present and former settlements

(a) Minni Minni

The vegetation on the site of the former settlement at Minni Minni is dominated by tall broadleaf trees, notably a line of Calophyllum inophyllum along the shore; a double line of massive Ficus religiosa extending from the lagoon shore to what was presumably the old manager's office, with other Ficus scattered amongst the remains of buildings; and, most massive of all, Barringtonia asiatica, the mature trees being surrounded by saplings 3-4 m tall. Hernandia sonora is common, and coconuts are largely absent from the settlement area proper. Terminalia catappa is represented by several large trees. The dense canopy and dark foliage of these trees form a dark, damp environment for ground cover. Alocasia macrorrhiza grows luxuriantly to heights of 3-4 m in

and around the old building sites, with abundant ferns (Asplenium spp., Thelypteris opulenta) and a moss (Syrrhopodon revolutus) on tree boles, logs and masonry. The ground vegetation includes weeds (Euphorbia cyathophora, Stachytarpheta jamaicensis) and relics of cultivation (decoratives such as Haemanthus multiflorus, a conspicuous red-flowering lily, Asclepias curassavica, Hemigraphis alternata).

A number of common cultivated trees are absent at Minni Minni, particularly Artocarpus and Mangifera, the decorative shrub Hibiscus, and also Casuarina. The first three may have been introduced to the atoll after the Minni Minni settlement had been abandoned.

The clump of trees south of Minni Minni, marked on charts as Minni Minni Knob, near the lagoon shore, consists of tall Calophyllum and Hernandia trees, and may be a former settlement site.

(b) East Point

The vegetation at the present main settlement at East Point is floristically the most diverse on the atoll. Many of the species are clearly deliberate introductions, and are found only in gardens under cultivation. Thus the manager's garden includes such trees as Albizia lebbeck, the Norfolk Island pine Araucaria columnaris (one tree only), Averrhoa bilimbi, Eugenia javanica, the kapok Ceiba pentandra, and the exotic palms Phoenix sp. and Hyphaene sp. There is an introduced bamboo Bambusa vulgaris. Introduced decoratives found planted round houses and along roadsides in the village include Asclepias curassavica, Catharanthus roseus, Crinum latifolium, Haemanthus multiflorus, Hibiscus rosa-sinensis, Hymenocallis littoralis, Pentas lanceolata, Pithecellobium dulce, and Zephyranthes rosea; Bidens sulphurea is also growing in the small cemetery. Species introduced for economic reasons (including food plants) include cotton Gossypium hirsutum, banana Musa sp., a mint Mentha sp., the taros Alocasia macrorrhiza and A. plumbea, and limes and oranges, Citrus spp. A number of vegetables, including eggplant and lettuce, are under cultivation. Massive trees of Ficus benghalensis are found to the north of the settlement, and tall Casuarina in the quadrangle between the manager's house and the jetty.

Many weedy species are found at and near East Point, some of which (such as Ipomoea pes-caprae and I. macrantha) may be indigenous, though rare elsewhere on Diego Garcia, whereas others are certainly introduced (Mimosa pudica, for example, is found only at the head of the East Point jetty). Common weeds include Achyranthes canescens, Boerhavia repens, Cassia occidentalis, Spermacoce suffrutescens, Euphorbia cyathophora, Hippobroma longiflora, Mikania micrantha, Passiflora suberosa, Sida parvifolia, Stachytarpheta jamaicensis, Striga asiatica, Tridax procumbens, Triumfetta procumbens and Vernonia cinerea. Pathways are lined with sedges and grasses, some of which have not been recorded elsewhere on the atoll (Cyperus compressus, Cyperus dubius, Cyperus ligularis, Cyperus

sphacelatus, Eleusine indica, Fimbristylis cymosa, Paspalum distichum, Stenotaphrum dimidiatum).

In 1885 Bourne (in Hemsley 1887, 334) found "bananas, sweet potatoes, bitter oranges, citrons and a few other tropical fruits. ... Maize is cultivated at Minny Minny." Bourne also collected Capsicum frutescens (Hemsley 1887, 339).

(c) Pointe Marianne

The settlement at Pointe Marianne is located on a lagoon beach ridge which encloses a wide area of standing fresh water, with dead and decapitated coconuts and Casuarina. The water contains a pondweed Bacopa monnieri, and the drying margins are being colonised by Paspalum distichum (?). The landward margins of the pool are covered with tall Casuarina and coconuts.

The lagoon beach at the settlement is fringed with massive trees of Calophyllum inophyllum, Hibiscus tiliaceus and Cordia subcordata, with Scaevola shrubs appearing only to the north and south. Between the houses of the settlement there are massive buttressed trees of Hernandia and Calophyllum, three tall trees of Artocarpus altilis, numerous Carica papaya, and some Musa sp., Terminalia catappa, and Mangifera indica. The ground cover consists of Wedelia biflora, Stachytarpheta jamaicensis, Euphorbia cyathophora, Hippobroma longiflora and Ageratum conyzoides. Near the manager's house there is a clump of sterile Pandanus, two trees of Leucaena leucocephala, and such flowering plants as Sida acuta, Pentas lanceolata and Ocimum gratissimum. Catharanthus roseus and Zephyranthes rosea are planted as decoratives round the houses. There is a long-disused cemetery south of Pointe Marianne, with tall Ficus and a number of relict cultivated plants, including Codiaeum variegatum.

B. Vegetation types

Wiehe (1939), in his general account of the Chagos atolls, discusses the vegetation in terms of (a) beach vegetation, (b) coconut groves, and (c) marshes. The following classification of the vegetation of Diego Garcia into eight categories is proposed largely as a means of organising the available information. The atoll land rim is so long and narrow, and the mosaic of vegetation types so intricate, that it must be regarded as highly approximate. The distribution of the main vegetation types has been mapped from air photographs in Figure 31, but though the photographs are of exceptional quality the small scale of the map means that it too is very generalised. Some comparisons are drawn in the following account with the vegetation of the other Chagos atolls, particularly Salomon and Peros Banhos, and of the southern Maldives.

1. Shoreline vegetation

(a) Scrub community of seaward beach

The scrub community of the seaward beach forms the most continuous and widespread vegetation unit on the atoll. Scaevola taccada forms a beach-crest hedge along almost the entire seaward coast (about 64 km) (Plate 5). Along the east coast, overlooking a wide beach, the Scaevola is tall (up to 6 m high) and bushy, forming a zone up to 50 m wide. Along the southeast, windward coast the Scaevola is much lower, wind-trimmed, and in places replaced by Tournefortia argentea. Along the west coast the Scaevola is again bushy, but in places the inland vegetation extends almost to the beach, especially in the south. Tournefortia argentea and Suriana maritima (Plate 35) occasionally replace Scaevola as the dominant species, and scattered bushes of Suriana are in places found to seaward of a continuous Scaevola hedge. On the inland side trees of Guettarda speciosa and Cocos nucifera are frequently found along the margin of or within the Scaevola belt.

Pemphis acidula has not been collected at Diego Garcia, though Wiehe (1939, 11) states that it is of more frequent occurrence than Suriana; Sophora tomentosa is likewise apparently absent, though both species are recorded from Addu Atoll, southern Maldives. No native Pandanus is found on Diego Garcia beaches, nor is the genus recorded from the Chagos Archipelago though present in the Maldives. A pioneer strand vegetation of vines, herbs and grasses is notably absent from seaward beaches of Diego Garcia: shrubs of Scaevola and associated species invariably form the outermost vegetation on Diego Garcia seaward shores.

(b) Lagoon-shore Scaevola community

Scaevola taccada is also the most widespread species on lagoon shores. It is dominant on the lagoon beach between Eclipse Point and Pointe Marianne, though forming only a narrow zone; from Pointe Marianne to Barachois Maurice, though limited over much of this tract by barachois development inland from the coast and the presence of a rock platform beneath a thin superficial cover of sand; and from Cust Point to Observatory Point, where the growth is more luxuriant on dune sands. Generally the plants are less bushy and more open in growth-form than on the seaward shore, and the zone may be only a few meters (a single plant) in width. Tournefortia occasionally replaces Scaevola, but Suriana is only found in place of Scaevola at the mouths of barachois, where it takes the place that Pemphis might be expected to occupy were it present. Coconuts crowd close to the lagoon beach. Where the Scaevola is more open there is a ground vegetation of grasses and sedges, but such vegetation is sparse and Ipomoea is almost completely absent.

(c) Lagoon-shore Calophyllum-Barringtonia community

Large shoreline trees of Calophyllum inophyllum and Barringtonia asiatica, with massive branches extending horizontally over the water

and lower trunks and roots washed by waves, are common only on the lagoon shore between Cust Point and East Point, especially around Minni Minni. A few are found at Pointe Marianne and near Eclipse Point, but otherwise they are confined to a lee shore. The beach here is narrow, steep and cliffed, held up by tree roots. Consequently there is no pioneer strand vegetation. Of the two common species, Calophyllum is more numerous though less massive than Barringtonia.

(d) Lagoon-shore mixed woodland

A lagoon shore woodland of Cordia subcordata, Guettarda speciosa and Hibiscus tiliaceus is uncommon on Diego Garcia, being restricted to the shore between East Point and Barachois Maurice and again south of Pointe Marianne, where it is interspersed with Scaevola. H. tiliaceus is quite common though Hemsley (1887, 336) stated that this species was absent from Diego Garcia.

(e) Dune scrub communities

Where the shoreline is backed by low dunes, either on the seaward or lagoon coasts, shrubby species are dominant. These old dune tracts may be extensive on the inland parts of the land rim, as between Northwest Point and Barton Point, and along most of the southeast coast of the atoll. Scaevola taccada is the most common shrub species, reaching a maximum height on the southeast rim of 5-8 m, and with a much more open growth-form on the coast. Other species locally dominant are Suriana maritima and Wedelia biflora. The sand surface under the shrubs is generally bare, with clumps of Fimbristylis cymosa, round which sand may be eroding, some Portulaca, and grasses. On the southeast rim this zone may reach a width of almost 1 km. Parts of the dune scrub here and near Barton Point and Eclipse Point have been cleared for coconuts.

2. Broadleaf woodland

Before the spread of planted coconuts, broadleaf woodland must have been much more extensive at Diego Garcia than now, but few remnants of this woodland now remain. La Fontaine in 1770 is said to have found a vegetation of "fatamaka [sic, Calophyllum inophyllum], bois blanc bon pour pirogues [Hernandia sonora?], bois à brûler [Pemphis acidula?]" (Unienville 1838, 182). Hemsley (1887, 333) quotes Findlay's (1870, 459) general statement concerning the Chagos: "On nearly every part of these islands there grow at intervals great clumps of gigantic trees, the Bois Mapou or Rose Tree, which attains an enormous size and height, even to 200 feet [60 m]. Their fallen and decayed trunks form a large portion of the vegetable world of the Archipelago". Bourne (1886, 387) suggests that the large tree is Pisonia inermis, and Hemsley (1887, 335-336) either Pisonia or Afzelia (= Intsia) bijuga.

Apart from exceptionally large nearshore Calophyllum inophyllum and Barringtonia asiatica, and occasional Ficus benghalensis at settlements, the only common large tree now present on Diego Garcia is Hernandia

sonora. In places, for example on the southern part of the west rim, this forms an open Hernandia woodland, elsewhere a mixed Hernandia-coconut woodland (Plate 36). Bourne (1886, 386) noted that Hernandia was "common, and may attain a considerable size; the natives use an infusion of the flowers as a medicine in gonorrheal complaints". Wiehe (1939) found Hernandia to be common and sometimes dominant.

Other species which may in the past have composed a native broad-leaf woodland are now rare or apparently absent. These include Intsia bijuga, Ochrosia oppositifolia, Pisonia grandis, and Cerbera odollam. Wiehe (1939, 13) described a forest of Intsia bijuga on Salomon Atoll, which was cut down in 1825; the largest tree had a trunk diameter of 2.8 m. Bourne (1886, 387) found "a single group of larger trees confined to a single spot on the northeast of the main island" on Diego Garcia, and Hemsley (1887, 336) states that there were then only four or five trees left. Because of depredation by rats, Bourne doubted that the species was replacing itself. Rhyné collected Intsia at East Point in 1967, but otherwise it was not seen. Ochrosia oppositifolia was recorded without comment (as O. borbonica) by Hemsley (1887, 1919) and Willis and Gardiner (1930) at Diego Garcia. A single tree was seen at the southern end of the west rim in 1967, height 12 m. Pisonia inermis (P. grandis) was recorded at Diego Garcia by Bourne (Hemsley 1887, 1919) and Willis and Gardiner (1930); and was noted in the Chagos generally by Wiehe (1939) as "a common tree, sometimes reaching heights of over 125 feet [38 m]". A single tree was seen on the atoll in 1967, on the seaward shore on the west rim, opposite Mamzelle Adélie. Wiehe (1939, 14) also noted Cerbera odollam as "a common tree in all the islands", but it has apparently not been specifically recorded from Diego Garcia and was not seen there in 1967.

Wiehe also mentions Guettarda speciosa and Thespesia populnea as common smaller trees, particularly near the shore, with the latter forming a dense thicket at the northwest point. This may be an error (? for Hibiscus tiliaceus) for the species has not otherwise been recorded from Diego Garcia, and was not found in 1967.

3. Coconut woodland

Cocos nucifera is clearly the dominant tree species in the land vegetation of Diego Garcia, and has been so since at least the middle of the seventeenth century (Horsburgh 1809, 131; Unieville 1838). Though at present coconut plantations are actively maintained near East Point and Pointe Marianne, coconut thicket with greater or lesser amounts of low trees and ground vegetation covers most of the atoll. Sauer (1967, 42-49) has argued from historical evidence and from propensity of Indian Ocean coconut palms to volunteer from drift nuts that the species is indigenous in the western Indian Ocean islands, and may have spread from there eastwards into the Pacific. At Diego Garcia, germinating drift seeds are particularly common on the lagoon shores of the northern islets, especially Middle Island, but are rare elsewhere; however, it is

these islands which alone on the atoll had no coconuts at the time of Bourne's visit in 1885. Without further historical evidence we can say little on the antiquity of coconuts on Diego Garcia, though it is probable that if they were introduced they were brought by pre-European sailors, a conclusion which applies to Cocos-Keeling, the rest of the Chagos, and other Indian Ocean reef islands.

Three types of coconut woodland can be distinguished on Diego Garcia:

(a) Coconut plantation

Intensively managed coconut plantations are found between East Point and Minni Minni, at Pointe Marianne, and southwest of Barachois Maurice (Plate 37). In these plantations the coconuts are planted in regular rows and the ground vegetation is usually not more than 0.5 m tall, though taller shrubs may grow between periods of clearing. Kalanchoe pinnata is one of the taller plants beneath the coconuts, replacing on Diego Garcia the Polynesian arrowroot Tacca leontopetaloides which is found in the Maldives and on many Pacific atolls. Kalanchoe is also recorded from Addu Atoll, southern Maldives, where, however, it is not common. Other widespread species in the ground layer include Achyranthes canescens, Rivina humilis, Passiflora suberosa, and the ferns Asplenium nidus and A. longissimum. On more open ground two small inconspicuous herbs are extremely common but may be overlooked: Pilea microphylla and Phyllanthus amarus. Striga asiatica is also common, especially on the east rim, where it grows to a height of 15 cm, compared with less than 5 cm on the drier atolls of the southwest Indian Ocean. The composition of the ground layer is rather restricted by comparison with similar habitats on other atolls: notably absent are certain members of the Euphorbiaceae such as Euphorbia chamissonis and E. atoto, common in other parts of the world. Epiphytes including ferns, Psilotum nudum and certain mosses are common, though less so in the more actively managed plantations, and the numerous piles of coconut husks, as well as tree trunks, are colonised by the moss Calymperes garciae.

(b) "Cocos Bon-Dieu"

More widespread than the managed plantations is a coconut woodland in which the coconuts themselves are irregularly distributed and largely self-sown, with intermediate storeys of small trees and tall shrubs 6-8 m tall and a luxuriant ground layer (Plate 38). In order of abundance the small tree layer consists of Morinda citrifolia, Pipturus argenteus, Guettarda speciosa and Scaevola taccada. Wiehe (1939) mentions Pipturus species as being common at Diego Garcia, and Premna obtusifolia as being present, though the latter was not collected in 1967. Examples of this woodland are found north of East Point, southwest of Barachois Maurice, and between Barachois Maurice and Carcasse. It is well developed between Barachois Sylvain and Mamzelle Adelle. The ground cover under Cocos Bon-Dieu consists of the species mentioned in the previous paragraph, except that Kalanchoe pinnata is absent.

(c) Mixed Coconut Woodland

Open coconut woodland is found in a few places mixed with Hernandia sonora and with a ground vegetation similar to that in actively managed coconut plantations. In places, as between Pointe Marianne and Mamzelle Adelie, a mixed woodland of coconuts with Guettarda speciosa and even trees of Tournefortia argentea is found. Tree density in such mixed woodland is generally low: there is no closed canopy and the vegetation is more open and park-like.

4. Casuarina Woodland

The status of Casuarina in the western Indian Ocean is uncertain. Often introduced in recent times, there is uncertain historical evidence for its pre-European occurrence on the Seychelles and Mascarene Islands, and Sauer (1967) considers it aboriginal in the former. It was first recorded from Diego Garcia by Bourne (1886, 386), who found "several clumps ... on the east side of the island ... [which] form conspicuous landmarks". Except at East Point, mature Casuarina is uncommon on the eastern rim today, though juveniles are common on Carcasse. The species is concentrated on the lagoon shore of the west rim, particularly from Pointe Marianne northwards (Plate 40), with juveniles invading coconut woodland. An extensive grove of pure Casuarina is found 1 km south of Eclipse Point on the lagoon shore, and the largest areas are near the seaward shore southwest of Eclipse Point.

5. Inland Marsh

At certain points on the land rim there is a depression between the lagoon and seaward ridges low enough to contain standing water or at least waterlogged soil. Near East Point, such depressions have a vegetation dominated by tall Alocasia macrorrhiza (Plate 42), the fern Asplenium longissimum, and sedges, but Alocasia is absent elsewhere on the land rim. Asplenium longissimum is common throughout the atoll in such situations. At the northeast point Thelypteris interrupta is found at the edge of standing water, and the sedge Eleocharis geniculata grows in the shallow water.

6. Barachois vegetation

The most striking feature of the barachois vegetation is its absence: no mangroves or associated species such as Acrostichum aureum are found on Diego Garcia, and in this respect the Chagos as a whole may be compared with the mangrove-free Tuamotus in the eastern Pacific. Mangroves are also absent from Cocos-Keeling Atoll in the eastern Indian Ocean, which in other respects also resembles Diego Garcia.

Six species of mangroves have been recorded from the Maldiv Islands, of which only three are known from the southernmost atoll, Addu. These are (Fosberg 1957, Fosberg, Groves and Sigee 1966):

<u>Sonneratia acida</u> L.	Malé, Miladumadulu, Addu
<u>Bruguiera cylindrica</u> (L.) Bl.	Malé, Goifurfehendu, Kolumadulu, Miladumadulu
<u>Bruguiera gymnorhiza</u> Lam.	Addu
<u>Rhizophora mucronata</u> Lam.	Suvadiva, Addu
<u>Lumnitzera littorea</u> (Jack.) Voight	Malé
<u>Lumnitzera racemosa</u> Willd.	Suvadiva

The mangrove-associated leather fern Acrostichum aureum has not been recorded from the Maldives. At Addu Atoll, none of the three recorded mangrove species form a woodland or "swamp," at least in the areas visited in 1964, and all are inconspicuous or rare.

Three mangrove species are recorded from the Chagos Archipelago, of which one is introduced. The two native species are Sonneratia acida L. (Ile Moresby, Peros Banhos) and Xylocarpus moluccensis (Lam.) Roemer, the latter an exclusive dominant in the marsh at Ile Boddam, Salomon Atoll (Wiehe 1939). Wiehe also noted the introduction of Rhizophora mucronata from Mauritius to Ile Boddam, Salomon, in 1935, but there is no information on the present status of this species.

This paucity in mangroves on atolls of the eastern and central Indian Ocean contrasts with their considerable development on atolls of the western Indian Ocean, for example in the high mangrove woodland at Aldabra Atoll, where eight species of mangroves are recorded. While the regional problem of absence of mangroves must result from ocean-wide dispersal patterns, it is likely that, at Diego Garcia itself, mangrove colonisation on lagoon shores and especially in barachois would have been limited by the elevation of the barachois floor, considerable tidal range, and distance from open water: even in mangrove areas such tracts are often either bare or sparsely colonised by Lumnitzera.

In the absence of mangroves, the barachois are relatively unvegetated. The sandy and muddy areas are devoid of vegetation except in patches which reach the approximate level of high spring tides. These are colonised by a wiry sterile grass (probably Paspalum distichum) and no other plants (Plates 12-15). In some of the barachois, especially at Mamzelle Adélie, these vegetated patches are more extensive and have the appearance, intersected by a branching creek system, of a salt marsh. Salt-marsh species, including primary colonisers, such as Arthrocnemum, are, however, absent. Most of the barachois are surrounded by rock ledges, again almost unvegetated except for patches of Portulaca. The transition to terrestrial vegetation, by a hedge of Scaevola, Suriana or Tournefortia, is usually sharp. Macroscopic algae are rare in the barachois, though a Schizothrix-like alga forms pink crusts on the higher areas, and another forms stromatolithic mounds at intermediate levels.

7. Settlement vegetation

Apart from the larger settlements at Pointe Marianne, Minni Minni, and particularly at East Point, there are numerous isolated houses round the atoll rim, which probably mark the centres of former land holdings. These are characteristically marked by one or two tall trees of Ficus benghalensis, often Terminalia catappa, and frequently a number of Carica papaya and Musa sp. Weeds such as Stachytarpheta, decorative plants, and food plants are also found near the houses.

Massive trees of Ficus benghalensis are found at all three main settlements, but particularly at Minni Minni (Plate 46). East Point and Pointe Marianne also have a number of introduced decorative and food species, some of great size, including Artocarpus altilis, Mangifera indica, Terminalia catappa, Albizia lebbbeck, Averrhoa bilimbi, Ceiba pentandra, Eugenia javanica and Araucaria columnaris. Cultivated deco-ratives include Catharanthus roseus, Hibiscus rosa-sinensis, and several lilies (Crinum sp., Haemanthus multiflorus, Hymenocallis littoralis, Zephyranthes rosea). Gossypium hirsutum is common at East Point but has not spread elsewhere, and the taros, Alocasia species, are also so re-stricted.

Many weedy species are restricted to East Point, clearly their point of introduction, or, if found elsewhere on the atoll, are especial-ly abundant at settlements. Several have been noted in Section A.10 and will not be repeated here. It is of interest that most of these species were apparently absent in the collections made by Hume (Hemsley 1884) and Bourne (Hemsley 1887), and though these were admittedly incomplete it is probable that many introduced species were not present eighty years ago. Wiehe (1939), however, records many exotics, and the 1967 collections added about thirty new records. These are documented in the list by Fosberg and Bullock in Chapter 12. In spite of the continual human interference with the vegetation of the atoll, it is remarkable that many of the introduced species are still so localised.

C. Summary

In summary, the most striking features of the vegetation of Diego Garcia are as follows:

1. The dominance of Scaevola taccada on both seaward and lagoon coasts, especially on the former. Tournefortia and Suriana are also present, but not Pemphis.
2. The dominance of coconut woodland inland, either in the form of actively managed and cleared plantations with a ground cover of Kalanchoe pinnata (but no Tacca), herbs and grasses, or a more irregular, denser woodland ("Cocos Bon-Dieu") of coconuts with a small layer of Guettarda, Morinda, Pipturus and Scaevola.

3. The widespread distribution of Hernandia sonora among the indigenous broadleaf trees, and the rarity of other species.
4. The limited distribution of very large littoral trees such as Calophyllum and Barringtonia.
5. The presence of massive trees of Ficus benghalensis and other cultivated trees at settlements.
6. The absence of Pandanus, except for two cultivated individuals.
7. The luxuriance of the fern flora (six species, dominated by Asplenium longissimum and A. nidus), of the bryophytes (especially Calymperes garciae on tree trunks and coconut husks), and to a lesser extent of the fungi, both on the ground and on rotting logs.
8. The absence of mangroves and associated vegetation.
9. The large number of recently introduced species, mainly at East Point, contrasting with the simplicity of the vegetation and restricted flora over most of the atoll.